UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND – REGION 1
5 Post Office Square, Suite 100
Mail Code OSRR07-4
Boston, MA 02109-3912

November 15, 2018

Chinny Esakkiperumal
Olin Corporation
3855 North Ocoee Street
Suite 200
Cleveland, TN 37312

RE: EPA Response to the following submittals from Olin:

1. A letter entitled *IRSWP Monitoring Program Optimization Proposal, Olin Chemical Superfund Site, Wilmington, Massachusetts*, dated July 29, 2013;
2. A letter entitled *Revised IRSWP Monitoring Program Optimization Proposal, Olin Chemical Superfund Site, Wilmington, Massachusetts*, dated June 13, 2016;
3. An email from James Cashwell subject *RE: Groundwater optimization proposal*, dated September 28, 2017;
4. A letter entitled *Request for Approval of Additional Investigation Task, Olin Chemical Superfund Site – Wilmington, MA*, dated July 3, 2018; and
5. A letter entitled *Verification of DAPL at Select Monitoring Locations, Olin Chemical Superfund Site (OCSS) – Wilmington, MA*, dated October 12, 2018.

Refer to this numbered list in EPA's response to the submissions below.

Dear Mr. Esakkiperumal,

In accordance with Paragraph 40 of the Administrative Settlement Agreement and Order on Consent for Remedial Investigation/Feasibility Study ("AOC") for the Olin Chemical Superfund Site (Site), the U.S. Environmental Protection Agency ("EPA") has completed a review of the submittals listed above. EPA's response is described below. Note that EPA has focused the response on the monitoring proposals contained within these documents. EPA's response in no way implies agreement with any statements made by Olin in these documents, including those concerning the conceptual site model (CSM) and the "stability" of contaminants in groundwater.

EPA Response to Submittals

Submittals 1-3

The June 2016 *Revised IRSWP Monitoring Program Optimization Proposal* supersedes the original July 2013 *IRSWP Monitoring Program Optimization Proposal*. Therefore, EPA has focused on a response to the 2016 revised optimization proposal and is not considering the 2013 document. James Cashwell provided further clarification on the 2016 revised proposal in a September 2017 email to Jim DiLorenzo. EPA's response below also addresses the contents of this email.

Olin has justified the proposed modifications to the IRSWP with a CSM that EPA maintains lacks supporting evidence. Therefore, EPA disapproves of the proposed changes to the monitoring plan as described in the June 2016 optimization proposal and James Cashwell's September 2017 email.

EPA's September 25, 2018 "Notice of Disapproval" letter to Olin provided comments on the 2018 *Draft OU3 RI Report* and *Draft OU3 Feasibility Study Report*. In these comments, EPA outlined the various lines of evidence that contradict Olin's current CSM of the slurry wall and containment area. Olin has maintained that dense aqueous phase liquid (DAPL) and diffuse groundwater in the containment area are effectively isolated from the surrounding aquifer. EPA's analysis shows this position to be unsupported by the data. Additionally, EPA continues to disagree with Olin's statements regarding the "stability" of contaminants within individual wells and Sitewide groundwater. Until more monitoring data is collected and consensus on the CSM and contaminant stability can be reached, there should be no reduction in monitoring of groundwater, surface water, or sediment in and around the containment area. Olin shall continue to perform monitoring of all media described in the optimization proposal in accordance with the approved 2008 *Interim Response Step Work Plan*, with the following exceptions:

- Groundwater Monitoring
  - Olin shall perform a comprehensive Sitewide round of groundwater sampling to evaluate groundwater chemistry and potential contaminants of concern (COCs), as described below ("Olin Revised Groundwater COC Monitoring Plan"). The following well screens discussed in Olin's optimization proposal are part of this comprehensive sampling round: GW-25, GW-26, GW-42S[1], GW-43SR, GW-34D, GW-34SR, GW-35S, GW-CA1, GW-78S, GW-201S, GW-79S, GW-202S, PZ-18R

    For these wells, in addition to continuing with the approved monitoring program outlined in the *2008 Interim Response Step Work Plan*, Olin shall implement the comprehensive sampling round.

[1] GW-42S is a multi-port well. James Cashwell's September 2017 email clarifies Olin is referring to MP-2 #13. EPA's Revised Groundwater Monitoring Plan for well GW-42S requires sampling of MP-2 #15.

- As part of EPA's "Olin Revised Groundwater COC Monitoring Plan," well GW-202D will be placed into a revised quarterly monitoring program and sampled for a more appropriate list of COCs. For this well, Olin shall discontinue the monitoring plan outlined in the 2008 *Interim Response Step Work Plan* and follow the new monitoring plan described below.

  See "Olin Revised Groundwater COC Monitoring Plan" below for a detailed description of this required sampling.

– Plant B Monitoring
  - All Plant B monitoring requirements will be addressed in a separate letter from EPA.

Submittal 4

Olin submitted a July 3, 2018 letter to EPA entitled *Request for Approval of Additional Investigation Task, Olin Chemical Superfund Site – Wilmington, MA*. Olin requests permission to implement a quarterly NDMA sampling program at 15 selected wells. EPA conditionally approves this plan. In addition to quarterly sampling for NDMA at these wells, Olin shall sample for additional COCs, as outlined in EPA's "Olin Revised Groundwater COC Monitoring Plan" (see below).

Submittal 5

Olin submitted an October 12, 2018 letter to EPA entitled *Verification of DAPL at Select Monitoring Locations, Olin Chemical Superfund Site (OCSS) – Wilmington, MA*. Olin proposes to "verify the presence or absence of dense aqueous phase liquid (DAPL) at select wells in the vicinity of the Main Street DAPL pool." EPA conditionally approves this plan, subject to the following conditions:

– Wells GW-44D, GW-45D, GW-59D, GW-70D, MP-3 (all available ports), MP-4 (all available ports): in addition to sampling for the parameters described in the proposal, Olin shall sample these wells for additional COCs in accordance with the comprehensive sampling round described below in EPA's "Olin Revised Groundwater COC Monitoring Plan".

– Wells GW-58D, GW-62D/BR/BRD, GW-83D: EPA has proposed these wells be placed in a quarterly sampling program described below in EPA's "Olin Revised Groundwater COC Monitoring Plan." In addition to the comprehensive sampling round, Olin shall sample these wells quarterly for all DAPL indicator parameters and COCs described in EPA's proposal.

As noted above, EPA has focused this response on Olin's monitoring proposals, and is not implying agreement with any statements made in these documents. However, it is worth pointing out a specific statement in this submittal which is an inaccurate

representation of EPA's CSM. Olin states: "…these wells did not have DAPL in the past but USEPA's version of CSM as indicated in the referenced comments is portraying that these wells should now have DAPL present." This statement is incorrect. EPA's position is that contamination (DAPL or diffuse groundwater) may be migrating via previously unidentified topographic low points in the bedrock of the Main Street DAPL basin. EPA's CSM does not predict the presence of DAPL at any given location; rather, it indicates that high concentrations of COCs may be present in areas of the Maple Meadow Brook Aquifer where sampling efforts have historically been limited. EPA's CSM illustrates the need for a comprehensive groundwater COC monitoring program, as described below.

Olin Revised Groundwater COC Monitoring Plan

Olin has proposed a variety of field investigations to investigate different aspects of the CSM. However, EPA's review of the *Draft OU3 RI Report* identified many data gaps, and there is clearly a need for a comprehensive monitoring program to fully evaluate the extent of contamination in groundwater. The implementation of this monitoring program should not delay the overall remedial investigation process, nor the development of the source control feasibility study. It is also important to note that EPA focused its recommendation on monitoring changes needed for the existing network of wells. As noted in our previous comments, there are data gaps that will require the installation of additional monitoring wells. The monitoring schedule for new wells will be established in future workplans. The monitoring requirements below will help provide information to scope future investigations, so this effort shall be completed in parallel with the on-going RI/FS process.

EPA's proposed monitoring plan has two main components:

- An initial comprehensive sampling round to delineate Sitewide vertical and horizontal extent of contamination; and
- A quarterly sampling program for a subset of wells to provide additional coverage for areas of concern and increased ability to perform contaminant trend evaluation.

<u>Analytes</u>

The initial comprehensive and quarterly sampling programs shall include a full evaluation of potential COCs in groundwater. Table 2 includes the contaminants that exceed screening criteria (RSLs, MCLs, and/or SMCLs) in more than 10% of total samples:

- VOCs: 1,2-DCA, chloroform, TCE
- SVOCs: NDMA
- Metals: aluminum, arsenic, hexavalent chromium, iron, manganese, sodium
- General chemistry: chloride, sulfate
- Specialty compounds: formaldehyde, hydrazine

In addition to these chemicals, TMPs are considered potential COCs. Although they do not have screening criteria, they are associated with groundwater contamination at the Site and are present at high concentrations.

Parameters historically considered to be indicative of DAPL should also be included in the comprehensive and quarterly sampling rounds to verify DAPL characteristics. These include ammonia, chloride, magnesium, sodium, sulfate, specific gravity, as well as field parameters such as pH and specific conductivity.

In summary, the analyte list for the initial comprehensive and quarterly groundwater sampling programs shall consist of the following:

- 1,2-DCA, chloroform, TCE
- SVOCs: NDMA
- Metals: aluminum, arsenic, hexavalent chromium, iron, manganese, sodium
- General chemistry: chloride, sulfate
- Specialty compounds: formaldehyde, hydrazine
- TMPs
- Other DAPL parameters: ammonia, magnesium
- Field parameters: pH, oxidation/reduction potential (ORP), temperature, dissolved oxygen, specific conductivity, specific gravity[2]

Initial Comprehensive Sampling Round

Olin shall complete a comprehensive sampling round to delineate Site-related COCs in groundwater. The last comprehensive sampling round was conducted from 2010 to 2012; over six years has passed since this sampling was completed, and numerous new wells have been installed. In addition to providing an updated snapshot of groundwater contamination at the Site, this sampling will help to verify the presence and extent of DAPL in the overburden and bedrock.

Olin shall sample a total of 205 screens/sample points (see Table 1, Figures 1-3) for the analytes listed above.

Quarterly Sampling

EPA previously completed a trend analysis for individual monitoring wells using several indicator parameters (ammonia, chloride, chromium, NDMA, and sulfate). However, the evaluation was limited because:

- Many of the wells were not regularly sampled for NDMA; and
- Some previous data are unusable for statistical evaluation because the detection limits for certain compounds are too high for consideration.

[2] EPA is only requiring specific gravity to be sampled at wells in the vicinity of DAPL pools; see Table 1.

After completing the initial Sitewide sampling event, Olin shall continue with a quarterly sampling program for 69 wells (see Table 1, Figures 1-3). This quarterly sampling will provide increased ability to analyze the spatial and temporal trends of COCs in groundwater and provide additional coverage for areas of concern, as described in the following subsections.

- DAPL Evaluation

  EPA has raised concerns regarding the variability in concentrations of the contaminants in the DAPL and diffuse groundwater layer (as defined by Olin). Samples should be collected from MP-1, MP-2, and MP-3 for long-term NDMA evaluation. EPA recommends the following:

  - Containment area DAPL pool: MP-1 #01 (deepest screen) and MP-1 #18 (shallow screen that had one previous sample with moderate NDMA; well above the DAPL layer).
  - Off-property/Jewel Drive DAPL pool: MP-2 #1 (deepest screen at this location) and MP-2 #9 (mid depth screen with previous high NDMA concentration).
  - Main Street DAPL pool: MP-3 #1 (deepest screen), MP-3 #7 (screen had a recent low NDMA concentration inconsistent with past concentrations), and MP-3 #19 (shallowest screen that recently had a high concentration of NDMA).

- Potential Impacts Southeast of Olin Property

  NDMA concentrations appear to extend to the southeast of the Olin property, with the leading edge of the plume ending close to GW-414S. Therefore, the wells southeast of the property and associated with the south ditch should also be included in the monitoring program. These include the following:

  - GW-4D: Southeast edge of Olin property; has high and apparently increasing NDMA concentrations.
  - GW-50S/D: High, but apparently decreasing concentrations of NDMA (higher in GW-50D).
  - GW-74D: Leading edge of NDMA plume.
  - GW-80D: Elevated NDMA concentrations close to the plume edge (GW-80D/BR included in Olin's program).

- Potential Impacts North of Olin Property

  Olin has identified a contaminant plume directly north of the property. This area should be evaluated further through a quarterly monitoring program.

- GW-32S/D: Elevated NDMA concentrations; potentially decreasing at GW-32D and fluctuating and low-moderate at GW-32S.
- GW-413D: Core of the plume in this area, with very high NDMA concentrations.
- GW-415D/BR: Apparent leading edge of the plume to the north.
- GW-416BR: Apparent leading edge of the plume to the northeast.

➢ Downgradient Plume Core

The downgradient plume core (from the Main Street DAPL pool through the MMBW) includes some of the highest NDMA concentrations detected. These wells should be monitored to help determine if the plume concentrations are migrating. These include the following wells that were selected to provide vertical and horizontal screen coverage.

- GW-58S/D: One of the highest NDMA concentrations detected was from GW-58D, which was sampled twice for NDMA. GW-58S should be monitored to confirm that concentrations are not increasing above this zone.
- GW-62M/D/BR/BRD: Upgradient of GW-83 cluster; GW-62M/D have moderate to high NDMA concentrations that may be increasing, while bedrock also has high concentrations.
- GW-69D: GW-69D has diffuse groundwater characteristics, is between DAPL pools and has very high and fluctuating NDMA concentrations that should be included in future trend analysis.
- GW-71D: This well is downgradient of the DAPL pools and has moderate NDMA concentrations but is separated from the main plume by the GW-66 cluster.
- GW-82S/D: These wells have moderate to high NDMA and are upgradient of the GW-83 cluster.
- GW-83S/M/D: GW-83D has concentrations indicative of DAPL (by Olin's definition). GW-83M and GW-83S should also be sampled to evaluate potential for vertical migration/diffusion of groundwater.
- GW-84M/D: GW-84D has extremely high and increasing NDMA concentrations, and GW-84M had NDMA detected for the first time in the most recent sample round.
- GW-85M/D: These wells have high NDMA concentrations, with fluctuating (GW-85D) and potentially increasing (GW-85M) concentrations that should be evaluated over time.
- GW-86M/D: GW-86D has high NDMA and specific conductivity values indicative of diffuse groundwater. GW-86M has moderate NDMA concentrations that should be evaluated if they are increasing.
- MP-4: This multi-port is immediately downgradient of the Main Street DAPL pool and has several ports screened within bedrock. It will be used to evaluate bedrock and deep overburden concentrations. Selected intervals include MP-4 #2 (deepest sample regularly collected; one high NDMA

sample), MP-4 #9 (at bedrock interface); and MP-4 #14 (low previous NDMA sample; this would be a sentinel well for shallow overburden).
- MP-5: This is the only multi-port location in the MMBW and will be used to determine concentration changes over a smaller scale than other monitoring points in this area. Selected intervals include MP-5 #3 (deepest port available, high NDMA) and MP-5 #15 (most shallow sample; would be used to confirm trend of moderate concentrations).

- On-Property Impacts

  Additional evaluation is needed to confirm concentration trends at the Olin property. On-site source areas (such as residual material remaining below the water table) may impact off-site groundwater migration in addition to the DAPL areas. Wells to sample in this area include:

  - GW-16R: Already sampled regularly; add NDMA to list to check moderate and potentially increasing concentrations.
  - GW-55S/D: Included in the area of diffuse groundwater south of the containment area; would provide additional data regarding off-site transport to the southeast.
  - GW-202D/BRS: Immediately southwest of containment area; part of current semi-annual sampling; moderate NDMA concentrations.
  - GW-408D: Immediately west of containment area; high NDMA in both shallow and deep overburden.

- Plume Edge

  Olin proposed several monitoring wells to evaluate concentrations close to the plume edge. EPA has identified additional wells to evaluate the plume edge, including the following.

  - GW-307: Has one extremely high NDMA detection and other high detection limits; to be used as sentinel well for impacts west of property.
  - GW-61BR: Concentrations appear to be increasing at this location east of the MMBW plume.
  - GW-65D: Concentrations of multiple contaminants appear to be increasing (GW-65BR/BRDD already included in Olin's proposed program).
  - GW-68BR: apparent increasing NDMA concentrations in bedrock.
  - GW-73D: NDMA was detected only in the last sample round, at a moderate concentration.
  - GW-88D: This location is cross-gradient of high concentrations in GW-63D; it should be monitored to ensure that concentrations in this area do not change.
  - GW-405BRD: Evaluate apparent increasing NDMA trends (other bedrock well screens have very low concentrations or non-detects).

- GW-406BRD: Evaluate extremely high but potentially decreasing NDMA trends west of the Olin industrial area.

EPA will work with Olin to evaluate the sampling results and may modify the quarterly monitoring program based upon the data (i.e., add or remove wells and analytes).

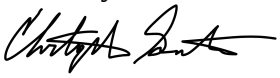
Next Steps

Within 30 days of receipt of this letter, Olin shall:

- Evaluate the sampling and analytical methods in the RI/FS Work Plan and the Quality Assurance Project Plan (QAPP) to determine if any updates are required;
- Submit a memorandum to EPA describing any required updates to the approved sampling and or analytical methods;
- Submit a memorandum to EPA describing the planned implementation of the comprehensive groundwater monitoring round; and
- Create tables that summarize the ongoing monitoring at the Site. Numerous modifications have been made to the sampling program since the RI/FS Work Plan was approved, and it is important that a written update be provided to avoid confusion. The tables should describe the monitoring program for all media (groundwater, surface water, soil/sediment). They should include a brief description of each sampling point, a list of the analytes that are tested for at the location, and the frequency at which sampling is required.

Please don't hesitate to contact me with any questions.

Sincerely,



Christopher Smith
Remedial Project Manager
USEPA Region 1 - New England

Figures

Figure 1 -- Revised COC Groundwater Monitoring Program: Shallow Wells

= Included in baseline (comprehensive) sampling

= Included in periodic NDMA sampling

BUTTERS ROW 2
BUTTERS ROW 1
GW-64S
GW-65S
GW-86S
CHESTNUT ST 1A/2
CHESTNUT ST 1
GW-63S
GW 400S
TOWN PARK
GW-73S
GW-404S
MP-5 #15
MP-5 #12
MP-5 #11
MP-5 #09
GW-88S
GW-84S
GW-61S
GW-67S
MW-203S
MW-206S
GW-62S
GW-58S
GW-82S
MW-204S
MP-4 #14
MP-4 #11
GW-413S
MP-3 #21
MP-3 #20
MP-3 #18
MP-3 #17
MP-3 #16
MP-3 #15
MP-3 #14
MP-3 #12
MP-3 #11
MP-3 #10
MP-3 #09
MP-3 #08
GW-44S
GW-47
GW-31S
GW-32S
GW-66S
GW-70S
GW-71S
GW-301
GW-21S
GW-302
IW 12
GW 13
IW-3
B-17
B-10
P5
GW-16R
GW-303
GW-53S
B-07-A
IW-2
B-05-R
B-03
GW-304
ECS-2
W-10
E-10
GW-305
ECS-6
GW-306
GW-308
IW-6
GW-100
IW-11
GW-101
GW-102
IW-10
GW-48S
IW-1
GW-14
GW-52S
ALTRON B1
ALTRON B3
GW-59S
GW-45S
GW-60S
GW-69S
GW-28S
GW-406
GW-54S
LPB 47
LPB 40
GW-29S
GW-43SR
GW-34SR
GW-26
GW-10S
GW-76S
GW-CA1
GW-CA2
GW-42S
MP-2 #17
MP-2 #16
MP-2 #15
MP-2 #14
MP-2 #13
MP-2 #12
MP-2 #08
GW-24
GW-25
GW-408S
GW-202S
GW-35S
GW-6S
GW-3S
GW-402D
MP-1 #17
MP-1 #16
MP-1 #14
MP-1 #13
MP-1 #12
GW-51S
GW-201S
GW-17S
PZ-24
PZ-18R
PZ-25
GW-77S
PZ-W3
PZ-W1
PZ-W2
GW-78S
PZ-17RR
GW-79S
PZ-16RR
GW-4
GW-39
GW-12
GW-55S
PZ-18
GW-403D
GW-50S
GW-8
GW-56S
SL-7
SL-8
GW-20
SL-1S
SL-6
SL-5
SL-2
GW-40S
SL-3
GW-80S
GW-74S
GW-401D

Legend

- Shallow Overburden Well
- Public Water Supply Well
- Containment Area
- 51 Eames St. Property Boundary
- Approximate DAPL Pool Boundary
- Ipswich and Aberjona Watershed Boundary
- Water
- Wetland Boundary
- Railroad
- Paved Road
- Unpaved Road
- Wilmington/Woburn Town Line

amec foster wheeler
Amec Foster Wheeler
Environment & Infrastructure, Inc.
271 Mill Road
Chelmsford, MA 01824

N

0 250 500 Feet

Figure 2.1-1
Shallow Overburden Monitoring Wells

OU3 Remedial Investigation
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared/Date: EFG 03/12/18 | Checked/Date: JBR 03/12/18

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Figure 2 -- Revised COC Groundwater Monitoring Program: Deep Wells

= Included in baseline (comprehensive) sampling

= Included in periodic NDMA sampling

BUTTERS ROW 2
BUTTERS ROW 1
GW-64D
GW-65D
GW-86D
GW-86M
GW-103D
CHESTNUT ST 1A/2
CHESTNUT ST 1
GW-63D
GW-87D
GW-85D
GW-85M
MP-5 #08
MP-5 #06
MP-5 #05
MP-5
GW-84D
GW-84M
GW-88M
GW-88D
GW-61D
GW-83D
GW-83M
GW-83S
GW-67D
MW-203D
MW-206D
GW-62D
GW-62M
GW-82D
GW-58D
MW-204D
MW-204M
MP-4 #13
MP-4 #12
MP-4 #10
GW-66D
GW-44D
MP-3 #19
MP-3 #06
MP-3 #05
MP-3 #04
MP-3 #03
MP-3 #02
MP-3 #01
GW-70D
GW-71D
GW-59D
GW-45D
GW-60D
GW-69D
GW-43D
GW-43DR
GW-42D
MP-2 #11
MP-2 #10
MP-2 #09
MP-2 #07
MP-2 #06
MP-2 #04
MP-2 #03
MP-2 #02
MP-2 #01
GW-68D
GW-46D
GW-36
GW-22D
GW-35D
GW-30DR
GW-37
GW-408D
PW-2
GW-202D
MP-1 #08
MP-1 #07
MP-1 #06
MP-1 #05
MP-1 #04
MP-1 #03
MP-1 #02
MP-1 #01
GW-55D
GW-56D
GW-81D
SL-1D
GW-18D
GW-75D
GW-72D
GW-49D
GW-80D
GW-74D
GW-414S
GW-50D
GW-5
GW-17D
GW-4D
GW-51D
GW-27D
GW-6D
GW-3D
GW-307
GW-34D
GW-10DR
GW-54D
GW-53D
IW-13
GW-28D
GW-15
GW-52D
GW-29D
GW-21D
GW-31D
GW-32D
GW-57D
GW-415D
GW-413D
GW-416D
GW-400D
GW-400M
TOWN PARK
GW-73D
GW-404D
GW-404M
SEA-3

Legend

- Deep Overburden Well
- Public Water Supply Well
- Containment Area
- 51 Eames St. Property Boundary
- Approximate DAPL Pool Boundary
- Ipswich and Aberjona Watershed Boundary
- Water
- Wetland Boundary
- Railroad
- Paved Road
- Unpaved Road
- Wilmington/Woburn Town Line

amec foster wheeler
Amec Foster Wheeler
Environment & Infrastructure, Inc.
271 Mill Road
Chelmsford, MA 01824

N

0 250 500 Feet

Figure 2.1-2
Deep Overburden Monitoring Wells

OU3 Remedial Investigation
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared/Date: EFG 03/12/18 | Checked/Date: JBR 03/12/18

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Figure 3 -- Revised COC Groundwater Monitoring Program: Bedrock Wells

= Included in baseline (comprehensive) sampling

= Included in periodic NDMA sampling

56/58 Butters Row
M-27/L-14C
M-15/L-02C
GW-400BR
M-03/L-02
M-03/L-02F
GW-407BRS
GW-407BRD
GW-65BR
GW-65BRDS
GW-65BRDD
GW-404BR
M-14/L-02B
M-03/L-102
GW-103BR
M-14/L-05
GW-61BR
M-02/L-07E
MW-203BR
MW-206BR
GW-62BRD
GW-62BR
MW-204BR
M-02/L-09A
GW-406BRD
GW-406BRS
M-13/L-03G
M-25/L-03
M-24/L-74
GW-405BRS
GW-405BRD
GW-68BR
BR-1
GW-202BRD
GW-202BRS
M-24/L-72A
M-24/L-65
GW-405BRM
GW-405BR
M-24/L-66
M-24/L-54
M-24/L-64
M-24/L-63
M-24/L-94
GW-81BR
M-01/L-06C
M-24/L-87A
GW-80BR
M-24/L-117
M-24/L-116

Legend

- Monitorig Well Sampled During RI Program
- Private Well Sampled After 2010
- Monitoring Well Not Sampled During RI Program
- 51 Eames St. Property Boundary
- Water
- Railroad
- Wetland Boundary

Note:
1. GW-1 Areas would include a 500 ft radius from residential wells and Zone II Areas.

amec foster wheeler
AMEC Environment & Infrastructure
271 Mill Road
Chelmsford, MA 01824

N

0 350 700 Feet

Figure 2.1-3
Bedrock Monitoring Wells

OU3 Remedial Investigation
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared/Date: BJR 11/10/14 | Checked/Date: PHT 11/10/14

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Tables

Table 1
Proposed Samples
Olin Chemical Superfund Site
Wilmington, Massachusetts

Well ID	Screen Elev. (ft MSL)	Last Year of Data	Revised GW COC Monitoring Progam			EPA Selection Notes
			Sitewide Initial Sampling	Specific Gravity	Quarterly Sampling	
GW-CA1	79 - 84	2016	Yes	--	--	Confirm low NDMA in equalization window
GW-3D	61 - 71	2010	Yes	--	--	East edge of Olin property; sporadic detections (sentinel well for east)
GW-3S	70 - 75	2010	Yes	--	--	East edge of Olin property; sporadic detections (sentinel well for east)
GW-4	67 - 72	2010	Yes	--	--	East edge of Olin property; apparent increasing NDMA
GW-4D	59 - 69	2010	Yes	--	Yes	East edge of Olin property; high and apparent increasing NDMA concentrations
GW-6D	61 - 71	2010	Yes	--	--	Confirm high but decreasing NDMA
GW-6S	74 - 79	2010	Yes	--	--	Anomalously high NDMA in last sample
GW-10D	56 - 66		Yes	--	--	Very high but decreasing NDMA
GW-16R	75 - 80	2017	Yes	--	Yes	Regularly sampled; add NDMA (moderate previous concentrations)
GW-17D	68 - 73	2010	Yes	--	--	Moderate NDMA at property edge, close to higher concentrations
GW-17S	72 - 77	2010	Yes	--	--	Anomalously low NDMA in last sample
GW-18D	67 - 72	2010	Yes	--	Yes	Southeast Olin property; very low detections
GW-21D	70 - 75	2010	Yes	--	--	Confirm low NDMA in northwest corner of property
GW-21S	70 - 80	2010	Yes	--	--	Confirm NDMA NDs in northwest corner of property
GW-25	unk.		Yes	--	--	Check NDMA trend at edge of Jewel Drive DAPL pool
GW-26	unk.	2012	Yes	--	--	Check NDMA trend above DAPL pool
GW-28D	69 - 79	2010	Yes	--	--	Confirm apparent decreasing NDMA trend on west property edge
GW-28S	72 - 82	2010	Yes	--	--	Check groundwater impacts on West Ditch
GW-29D	55 - 65	2010	Yes	--	--	Evaluate erratic and possibly decreasing concentrations north of slurry wall
GW-29S	70 - 80	2010	Yes	--	--	Check erratic NDMA north of slurry wall
GW-31D	68 - 78	2010	Yes	--	--	Confirm low NDMA next to GW-32D
GW-32D	56 - 66	2010	Yes	--	Yes	North edge of Olin property; high NDMA
GW-32S	73 - 83	2010	Yes	--	Yes	North edge of property; low/erratic NDMA
GW-34D	55 - 65	2013	Yes	--	--	Immediately north of slurry wall - low NDMA
GW-34SR	73 - 83	2013	Yes	--	--	Immediately north of slurry wall - low NDMA
GW-35D	47 - 57	2003	Yes	Yes	--	Confirm chemistry in DAPL pool
GW-35S	67 - 77	2016	Yes	--	--	Confirm chemistry above DAPL pool
GW-39	69 - 79	2010	Yes	--	--	South of DAPL pools; low NDMA
GW-40S	66 - 76	2010	Yes	--	--	Most southeast SOB well - confirm NDMA ND
GW-43D	52 - 62	2004	Yes	Yes	--	Concentrations indicative of DAPL in 2004; should be resampled if possible
GW-43SR	68 - 78	2013	Yes	--	--	Confirm ND NDMA between DAPL pools
GW-44D	19 - 29	2012	Yes	Yes	--	Check extremely high NDMA in last sample
GW-44S	64 - 74	2012	Yes	--	--	Confirm NDMA NDs above DAPL pool
GW-45D	27 - 37	2010	Yes	Yes	--	Confirm DAPL chemistry and NDMA concentrations
GW-45S	68 - 78	2010	Yes	--	--	Confirm low NDMA above DAPL pool
GW-46D	66 - 76	2010	Yes	--	--	Confirm NDMA ND at plume edge
GW-48S	61 - 71	2010	Yes	--	--	Confirm NDMA ND northeast of property
GW-50S	62 - 72	2010	Yes	--	Yes	sentinel well for off-property transport to southeast

Table 1
Proposed Samples
Olin Chemical Superfund Site
Wilmington, Massachusetts

Well ID	Screen Elev. (ft MSL)	Last Year of Data	Revised GW COC Monitoring Progam			EPA Selection Notes
			Sitewide Initial Sampling	Specific Gravity	Quarterly Sampling	
GW-50D	37 - 47	2010	Yes	--	Yes	sentinel well for off-property transport to southeast
GW-51D	64 - 74	2010	Yes	--	--	Confirm apparent decreasing NDMA trend on west property edge
GW-52D	65 - 75	2010	Yes	--	--	Confirm NDMA ND south of Plant B
GW-52S	76 - 81	2010	Yes	--	--	Confirm low NDMA south of Plant B
GW-53D	68 - 78	2010	Yes	--	--	Confirm moderate NDMA; check concentrations west of Plant B
GW-53S	79 - 84	2010	Yes	--	--	Confirm low NDMA west of Plant B
GW-55D	60 - 70	2010	Yes	Yes	Yes	High NDMA concentrations; specific conductivity data not available, but assumed to be diffuse groundwater.
GW-55S	70 - 75	2010	Yes	--	Yes	Diffuse concentrations; possibly increasing NDMA
GW-56D	56 - 66	2010	Yes	--	--	Check increasing NDMA concentrations
GW-56S	66 - 76	2010	Yes	--	--	Check increasing NDMA concentrations
GW-57D	64 - 74	2012	Yes	--	--	Confirm NDMA NDs north of DAPL pool
GW-58S	68 - 78	2010	Yes	--	Yes	Above GW-58D
GW-58D	16 - 26	2010	Yes	Yes	Yes	extremely high NDMA concentrations; limited sampling
GW-59D	21 - 36	2004	Yes	Yes	--	Confirm high 2004 NDMA (if well available)
GW-59S	65 - 75	2004	Yes	--	--	Confirm NDMA ND above DAPL
GW-60D	58 - 68	2011	Yes	--	--	Confirm NDMA NDs south of plume
GW-60S	72 - 82	2011	Yes	--	--	Confirm NDMA NDs south of plume
GW-61D	62 - 72	2010	Yes	--	--	Check NDMA NDs near plume core
GW-61BR	-10 - 10	2010	Yes	--	Yes	Apparent increasing NDMA in bedrock
GW-62BRD	-63 - -23	2010	Yes	Yes	Yes	Diffuse groundwater; potential increasing contaminant trend; high NDMA
GW-62BR	-23 - 1.6	2010	Yes	Yes	Yes	Concentrations close to that of DAPL definition; extremely high NDMA, but only 2 samples
GW-62D	11 - 21	2010	Yes	Yes	Yes	high and potentially increasing NDMA concentrations
GW-62M	42 - 52	2010	Yes	--	Yes	Monitor potentially increasing concentrations
GW-62S	67 - 77	2010	Yes	--	--	Confirm NDMA NDs
GW-63D	47 - 57	2010	Yes	--	Yes	Check high NDMA concentrations upgradient of Chestnut Street
GW-64D	18 - 28	2010	Yes	--	Yes	Sentinel well for plume transport to northwest; moderate NDMA concentrations
GW-64S	64 - 74	2010	Yes	--	--	Confirm NDs for plume edge
GW-65BR	-57 - -27	2011	Yes	--	Yes	Collect sufficient data for plume trends below GW-65D
GW-65BRDD		2011	Yes	--	Yes	Collect sufficient data for plume trends below GW-65D
GW-65BRDS		2011	Yes	--	--	Check NDMA between BR-65BRDD and GW-65D
GW-65D	-16 - -1	2011	Yes	--	Yes	High and increasing NDMA in downgradient plume
GW-65S	64 - 74	2011	Yes	--	--	Check recent low NDMA detection
GW-66D	45 - 55	2010	Yes	--	--	Check NDMA non-detects downgradient of DAPL pool
GW-66S	69 - 79	2010	Yes	--	--	Check NDMA non-detects downgradient of DAPL pool
GW-67D	11 - 26	2010	Yes	--	--	Check NDMA non-detects near plume core

Table 1
Proposed Samples
Olin Chemical Superfund Site
Wilmington, Massachusetts

Well ID	Screen Elev. (ft MSL)	Last Year of Data	Revised GW COC Monitoring Progam			EPA Selection Notes
			Sitewide Initial Sampling	Specific Gravity	Quarterly Sampling	
GW-67S	71 - 81	2010	Yes	--	--	Check NDMA non-detects near plume core
GW-68BR	14 - 59	2010	Yes	--	Yes	Evaluate apparent increasing NDMA trend
GW-68D	73 - 83	2010	Yes	--	--	Confirm NDMA nopn-detects south of DAPL pool
GW-69D	45 - 55	2010	Yes	Yes	Yes	Evaluate erratic and very high NDMA in deep overburden between DAPL pools
GW-69S	68 - 78	2010	Yes	--	--	Confirm decreasing NDMA between DAPL pools
GW-70D	30 - 40	2011	Yes	--	--	Far end of Main Street DAPL pool - confirm that concentrations are comperable to MP-3
GW-70S	68 - 78	2011	Yes	--	--	Confirm recent ND NDMA results
GW-71D	45 - 55	2010	Yes	--	Yes	Moderate NDMA levels; only 2 results
GW-71S	71 - 81	2010	Yes	--	--	NDMA detected in last sample; only 2 results
GW-73D	19 - 29	2010	Yes	--	Yes	Check elevated NDMA in last sample round
GW-74D	48 - 58	2010	Yes	--	Yes	Confirm ND at southeast plume edge
GW-75D	35 - 45	2012	Yes	--	Yes	Confirm most recent NDMA ND
GW-78S	74 - 83	2017	Yes	--	--	Check impacts to South Ditch immediately south of containment cell
GW-79S	69 - 79	2013	Yes	--	--	Check high but potentially decreasing NDMA close to South Ditch
GW-80BR	9 - 49	2011	Yes	--	Yes	Apparent increasing NDMA at plume edge
GW-80D	59 - 69	2011	Yes	--	Yes	Apparent increasing NDMA at plume edge
GW-80S	71 - 76	2011	Yes	--	--	Leading edge of shallow NDMA plume
GW-81BR	36 - 65	2010	Yes	--	Yes	Confirm low NDMA at plume edge
GW-81D	71 - 81	2010	Yes	--	Yes	Confirm low NDMA southwest of property
GW-82D	20 - 30	2010	Yes	--	Yes	High NDMA; few previous sample events.
GW-82S	56 - 66	2010	Yes	--	Yes	Moderate NDMA; few sample events.
GW-83D	-31 - -41	2011	Yes	Yes	Yes	DAPL location in MMBW
GW-83M	-4 - 16	2011	Yes	--	Yes	High and apparently increasing NDMA
GW-83S	31 - 41	2013	Yes	--	Yes	Moderate and apparently increasing NDMA
GW-84D	-26 - -11	2010	Yes	Yes	Yes	Very high NDMA detecteed, especially in last round
GW-84M	4 - 19	2010	Yes	--	Yes	Check NDMA detection in last sample.Above extremely high and increasing NDMA concentrations.
GW-84S	34 - 44	2010	Yes	--	--	Check NDMA NDs near plume core
GW-85D	-11 - -1	2016	Yes	--	Yes	High and fluctuating NDMA detections require additional evaluation
GW-85M	15 - 35	2016	Yes	--	Yes	High NDMA detected; most recent sample was significantly higher than others.
GW-86D	-2 - -12	2016	Yes	--	Yes	High and potentially increasing NDMA detections
GW-86M	16 - 31	2006	Yes	--	Yes	Moderate NDMA detected; above high NDMA
GW-86S	53 - 63	2010	Yes	--	--	Confirm NDMA non-detects
GW-87D	-19 - -29	2011	Yes	--	--	Deepest well screen in area; high NDMA detections
GW-88D	unk.	2010	Yes	--	Yes	Confirm NDMA non-detects at plume edge
GW-88M	unk.	2010	Yes	--	--	Confirm NDMA non-detects
GW-101	69 - 80	2012	Yes	--	--	Confirm NDMA non-detect at Plant B area
GW-103BR	-25 - -1	2010	Yes	--	Yes	Moderate NDMA at far plume edge, downgradient of Chestnut Street

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Proposed Samples
Olin Chemical Superfund Site
Wilmington, Massachusetts

Well ID	Screen Elev. (ft MSL)	Last Year of Data	Revised GW COC Monitoring Progam			EPA Selection Notes
			Sitewide Initial Sampling	Specific Gravity	Quarterly Sampling	
GW-103D	22 - 32	2010	Yes	--	Yes	Moderate NDMA at far plume edge, downgradient of Chestnut Street
GW-201S	69 - 79	2016	Yes	--	--	Confirm concentrations east of slurry wall
GW-202BRD		2011	Yes	--	--	Check high NDMA trends in bedrock near slurry wall
GW-202BRS		2011	Yes	Yes	Yes	Evaluate high NDMA trends in bedrock near slurry wall
GW-202D	64 - 74	2017	Yes	Yes	Yes	Monitor high NDMA detections southwest of slurry, close to South Ditch
GW-202S	74 - 82	2017	Yes	--	--	Check high NDMA detections southwest of slurry wall, close to South Ditch
GW-305	71 - 81	2010	Yes	--	--	Check high NDMA - industrial area
GW-307	66 - 76	2010	Yes	--	Yes	Extremely high NDMA at east property edge
GW-400BR		2012	Yes	--	--	Confirm NDMA non-detectss in bedrock beyond low concentrations at GW-404BR
GW-400D		2012	Yes	--	Yes	Confirm NDMA NDs at far plume edge
GW-401D		2011	Yes	--	--	Confirm NDMA NDs at southeast plume edge
GW-402D		2011	Yes	--	--	Confirm NDMA NDs east of Olin property
GW-403D		2010	Yes	--	--	Confirm NDMA NDs east of Olin property
GW-404BR		2013	Yes	--	Yes	Confirm far edge of plume (low NDMA)
GW-404D		2013	Yes	--	--	Confirm far edge of plume (low NDMA)
GW-404M		2013	Yes	--	--	Confirm far edge of plume in overburden
GW-405BRD		2011	Yes	--	Yes	Evaluate apparent increasing NDMA trend
GW-405BRM		2011	Yes	--	--	Confirm low NDMA in bedrock
GW-405BRS		2011	Yes	--	--	Confirm low NDMA in bedrock
GW-406BRD		2011	Yes	--	Yes	Evaluate high NDMA trends in bedrock west of industrial area
GW-406BRS		2011	Yes	--	--	Check moderate NDMA levels in bedrock west of industrial area
GW-407BRD		2011	Yes	--	--	Confirm low NDMA in bedrock close to Butters Row
GW-407BRS		2011	Yes	--	--	Confirm low NDMA in bedrock close to Butters Row
GW-408D		2011	Yes	--	Yes	Monitor high NDMA detections next to slurry wall
GW-408S		2011	Yes	--	--	Check high NDMA detections next to slurry wall
GW-413BR		2017	Yes	--	--	core of NDMA bedrock plume north of Olin property
GW-413D		2017	Yes	--	Yes	core of NDMA plume north of Olin property
GW-413S		2016	Yes	--	--	Above core of NDMA plume north of Olin
GW-414S		2016	Yes	--	--	leading edge of NDMA plume in deep overburden
GW-415BR		2017	Yes	--	Yes	leading edge of NDMA plume in bedrock
GW-415D		2017	Yes	--	Yes	leading edge of NDMA plume in deep overburden
GW-416BR		2017	Yes	--	Yes	leading edge of NDMA plume in bedrock
GW-416D		2017	Yes	--	--	leading edge of NDMA plume in deep overburden

Table 1
Proposed Samples
Olin Chemical Superfund Site
Wilmington, Massachusetts

Well ID	Screen Elev. (ft MSL)	Last Year of Data	Revised GW COC Monitoring Progam			EPA Selection Notes
			Sitewide Initial Sampling	Specific Gravity	Quarterly Sampling	
ML-1 #5	53 - 54	2013	Yes	Yes	--	Above DAPL; should confirm MP-2 concentrations
MP-1 #1	46 - 47	2012	Yes	Yes	Yes	Only DAPL regularly sampled in containment cell; lowest port available
MP-1 #3	51 - 52	2003	Yes	Yes	--	Uppermost port in DAPL
MP-1 #4	54 - 55	2012	Yes	Yes	--	Concentrations changing from DAPL to diffuse
MP-1 #6	58 - 59	2012	Yes	Yes	--	Uppermost port in diffuse material
MP-1 #8	61 - 62	2012	Yes	--	--	Confirm previous low NDMA detection
MP-1 #11	65 - 66	1998	Yes	--	--	Confirm general chemistry above diffuse layer
MP-1 #14	70 - 71	2012	Yes	--	--	Confirm general chemistry above diffuse layer
MP-1 #18	79 - 80	2005	Yes	--	Yes	Highest port; approximate elev. of equalization window
MP-2 #1	46 - 47	2012	Yes	Yes	Yes	Lowest port available; high NDMA
MP-2 #3	51 - 52	2013	Yes	Yes	--	No NDMA data available; above high levels
MP-2 #4	53 - 54	2012	Yes	Yes	--	Concentrations appear to be decreasing; may change to diffuse. No NDMA data available.
MP-2 #6	56 - 57	2013	Yes	Yes	--	Decreasing concentrations; changed from DAPL to diffuse
MP-2 #7	58 - 59	2010	Yes	--	--	May change from diffuse to overlying groundwater
MP-2 #9	61 - 62	2012	Yes	--	Yes	Previous high NDMA concentration
MP-2 #11	66 - 67	2012	Yes	--	--	Above previous high NDMA concentrations
MP-2 #15	73 - 74	2010	Yes	--	--	Confirm single previous NDMA ND
MP-3 #1	24 - 25	2012	Yes	Yes	Yes	Lowest point; may indicate chemistry changes/migration to bedrock
MP-3 #2	30 - 31	2003	Yes	Yes	--	Suggested by Olin
MP3 #3	34 - 35	2012	Yes	Yes	--	Upper DAPL; confirm concentration trends
MP-3 #4	39 - 40	2012	Yes	Yes	--	Cose to edge of DAPL boundary
MP-3 #5	42 - 43	2012	Yes	Yes	--	Suggested by Olin
MP-3 #6	45 - 46	2004	Yes	Yes	--	Suggested by Olin
MP-3 #7	46 - 47	2012	Yes	Yes	Yes	Anomalously low NDMA in last sample
MP-3 #8	48 - 49	2003	Yes	--	--	Suggested by Olin
MP-3 #9	49 - 50	2003	Yes	--	--	Suggested by Olin
MP-3 #10	51 - 52	1998	Yes	--	--	Suggested by Olin
MP-3 #11	52 - 53	2003	Yes	--	--	Suggested by Olin
MP-3 #12	54 - 55	1996	Yes	--	--	Suggested by Olin
MP-3 #13	55 - 56	2012	Yes	--	--	Range of data for trend analysis
MP-3 #14	58 - 59	1996	Yes	--	--	Suggested by Olin
MP-3 #15	61 - 62	1998	Yes	--	--	Suggested by Olin
MP-3 #16	65 - 66	1996	Yes	--	--	Suggested by Olin
MP-3 #17	68 - 69	1998	Yes	--	--	Suggested by Olin
MP-3 #18	72 - 73	2004	Yes	--	--	Suggested by Olin
MP-3 #19	73 - 74	2012	Yes	--	Yes	should be overlying, but have previous high NDMA
MP-3 #20	75 - 76	1996	Yes	--	--	Suggested by Olin
MP-3 #21	76 - 77	2012	Yes	--	--	Suggested by Olin
MP-4 #1	-70 - -71	2003	Yes	Yes	--	Deepest port available
MP-4 #2	-60 - -59	2012	Yes	Yes	Yes	deepest sample regularly collected, one high NDMA result

Table 1
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Olin Chemical Superfund Site
Wilmington, Massachusetts

Well ID	Screen Elev. (ft MSL)	Last Year of Data	Revised GW COC Monitoring Progam			EPA Selection Notes
			Sitewide Initial Sampling	Specific Gravity	Quarterly Sampling	
MP-4 #3	-47 - -48	2012	Yes	Yes	--	Diffuse groundwater; range of sample dates for trends
MP-4 #5	-15 - -14	2010	Yes	Yes	--	Diffuse groundwater; range of sample dates for trends
MP-4 #8	21 - 22		Yes	Yes	--	Suggested by Olin
MP-4 #9	31 - 32	2000	Yes	Yes	Yes	Bedrock interface; below very high NDMA detections
MP-4 #10	35 - 36	2012	Yes	Yes	--	Very high NDMA concentrations in 2003/4
MP-4 #11	40 - 41		Yes	--	--	Suggested by Olin
MP-4 #12	45 - 46	2010	Yes	--	--	moderate NDMA in deep overburden
MP-4 #13	56 - 57		Yes	--	--	Suggested by Olin
MP-4 #14	71 - 72	2004	Yes	--	Yes	low NDMA in shallow overburden
MP-5 #3	-21 - -19	2011	Yes	Yes	Yes	high NDMA in bedrock; deepest port available
MP-5 #6	-7 - -9	2005	Yes	Yes	--	Apparent top of diffuse zone (based on pre-RI data)
MP-5 #8	-3 - -1	2011	Yes	--	--	high NDMA in deep overburden
MP-5 #11	9 - 11	2005	Yes	--	--	No NDMA data available - above high concentrations
MP-5 #12	31 - 33	2005	Yes	--	--	No NDMA data available - above high concentrations
MP-5 #15	53 - 55	2011	Yes	--	Yes	Moderate NDMA in shallow overburden
MW-203BR	unk.	2011	Yes	--	--	Confirm NDMA non-detects south of plume
MW-204BR	unk.	2011	Yes	--	--	Confirm last NDMA non-detect south of plume
MW-204D	9 - 19	2011	Yes	--	--	Confirm NDMA non-detects south of plume
MW-204M	35 - 45	2011	Yes	--	--	Confirm NDMA non-detects south of plume
MW-204S	57 - 62	2011	Yes	--	--	Confirm NDMA non-detects south of plume
PZ-18R	76 - 78	2017	Yes	--	--	Check shallow NDMA close to South Ditch
SL-6	69 - 79	2016	Yes	--	--	Sentinel well - confirm NDMA ND to south

Notes:

dark yellow shading = DAPL (dense aqueous phase liquid); orange shading = diffuse groundwater;

Dark red shading = trend is increasing and statistically significant. Light red shading = trend is increasing and not statistically signif

Dark blue shading = trend is decreasing and statistically significant. Light blue shading = trend is decreasing and not statistically si

Yellow shading = no apparent increasing or decreasing trend.

Table 2
Groundwater Exceedances Since May 2010 - More than 10 Detections
Summary Statistics and Criteria Comparisons
Olin Chemical, Wilmington, Massachusetts

Chemical	Units	Analyzed	Detects	Non Detects	Min Det	Max Det	Avg Det	Det Range	Max Location	RSL GwTapJun2017			MCL			SMCL		
										Value	# Exceed	% Exceed	Value	# Exceed	% Exceed	Value	# Exceed	% Exceed
Volatile Organic Compounds																		
1,1-Dichloroethane	ug/L	426	46	380	0.21	230	8.45	0.21 - 230	GW-80BR	2.8	6	1.4%	NS	--	--	NS	--	--
1,2,4-Trichlorobenzene	ug/L	426	12	414	0.26	2	0.883	0.26 - 2	GW-58D; GW-69D	0.4	10	2.3%	70	0	0.0%	NS	--	--
1,2,4-Trimethylbenzene	ug/L	426	16	410	0.21	15	4.36	0.21 - 15	GW-80D	5.6	4	0.9%	NS	--	--	NS	--	--
1,2-Dichlorobenzene	ug/L	426	19	407	0.21	200	22.5	0.21 - 200	GW-80BR	30	2	0.5%	600	0	0.0%	NS	--	--
1,2-Dichloroethane	ug/L	426	52	374	0.26	23	4.22	0.26 - 23	GW-45D; GW-83D	0.17	52	**12.2%**	5	11	2.6%	NS	--	--
1,4-Dichlorobenzene	ug/L	426	19	407	0.35	5.2	1.25	0.35 - 5.2	GW-80D	0.48	15	3.5%	75	0	0.0%	NS	--	--
Benzene	ug/L	426	52	374	0.2	110	8.56	0.2 - 110	GW-80BR	0.46	39	9.2%	5	11	2.6%	NS	--	--
Bromodichloromethane	ug/L	426	23	403	0.22	7.5	2.02	0.22 - 7.5	MP-1 #01	0.13	23	5.4%	80	0	0.0%	NS	--	--
Bromoform	ug/L	426	21	405	0.59	55	12.7	0.59 - 55	MP-1 #01	3.3	16	3.8%	80	0	0.0%	NS	--	--
Chlorobenzene	ug/L	426	23	403	0.36	1400	118	0.36 - 1400	GW-80BR	7.8	4	0.9%	100	2	0.5%	NS	--	--
Chloroform	ug/L	426	47	379	0.2	93	15.1	0.2 - 93	MP-3 #01	0.22	**44**	**10.3%**	80	4	0.9%	NS	--	--
cis-1,2-Dichloroethene	ug/L	426	78	348	0.25	190	22.4	0.25 - 190	GW-407BRS	3.6	30	7.0%	70	8	1.9%	NS	--	--
Dibromochloromethane	ug/L	426	21	405	0.24	170	12.4	0.24 - 170	MP-1 #01	0.87	17	4.0%	80	1	0.2%	NS	--	--
Dibromomethane	ug/L	426	18	408	0.33	11	4.22	0.33 - 11	MP-1 #06	0.83	16	3.8%	NS	--	--	NS	--	--
Ethylbenzene	ug/L	426	25	401	0.21	260	26.4	0.21 - 260	GW-80BR	1.5	18	4.2%	700	0	0.0%	NS	--	--
m,p-Xylene	ug/L	426	13	413	0.52	850	141	0.52 - 850	GW-80BR	19	6	1.4%	10000	0	0.0%	NS	--	--
Methyl tert-butyl ether	ug/L	426	112	314	0.19	39	4.05	0.19 - 39	MP-5 #08	14	7	1.6%	NS	--	--	NS	--	--
Methylene chloride	ug/L	426	28	398	1.4	270	19	1.4 - 270	GW-80BR	11	9	2.1%	5	15	3.5%	NS	--	--
o-Xylene	ug/L	425	18	407	0.2	200	23.7	0.2 - 200	GW-80BR	19	3	0.7%	10000	0	0.0%	NS	--	--
Toluene	ug/L	426	46	380	0.2	13000	523	0.2 - 13000	GW-80BR	110	5	1.2%	1000	2	0.5%	NS	--	--
trans-1,2-Dichloroethene	ug/L	426	17	409	0.26	78	9.8	0.26 - 78	GW-80BR	36	2	0.5%	100	0	0.0%	NS	--	--
Trichloroethene	ug/L	426	69	357	0.21	270	14.6	0.21 - 270	GW-58D	0.28	**65**	**15.3%**	5	25	5.9%	NS	--	--
Vinyl chloride	ug/L	426	38	388	0.24	83	9.68	0.24 - 83	GW-87D	0.019	38	8.9%	2	13	3.1%	NS	--	--
Semi-Volatile Organic Compounds																		
1,1'-Biphenyl	ug/L	563	28	535	0.48	27	2.74	0.48 - 27	GW-15	0.083	28	5.0%	NS	--	--	NS	--	--
Benzaldehyde	ug/L	563	17	546	0.096	20	4.88	0.096 - 20	GW-80BR	19	1	0.2%	NS	--	--	NS	--	--
Benzo(a)anthracene	ug/L	563	16	547	0.037	1.1	0.293	0.037 - 1.1	GW-80S	0.03	16	2.8%	NS	--	--	NS	--	--
Benzo(a)pyrene	ug/L	563	28	535	0.094	1.2	0.226	0.094 - 1.2	GW-80S	0.025	28	5.0%	0.2	9	1.6%	NS	--	--
Benzo(b)fluoranthene	ug/L	563	20	543	0.13	1.7	0.374	0.13 - 1.7	GW-80S	0.25	8	1.4%	NS	--	--	NS	--	--
Bis(2-ethylhexyl)phthalate	ug/L	629	95	534	0.41	200	5.1	0.41 - 200	IW-13	5.6	8	1.3%	6	7	1.1%	NS	--	--
Dibenz(a,h)anthracene	ug/L	563	29	534	0.059	0.54	0.172	0.059 - 0.54	GW-80D	0.025	29	5.2%	NS	--	--	NS	--	--
Indeno(1,2,3-cd)pyrene	ug/L	563	29	534	0.078	0.93	0.247	0.078 - 0.93	GW-80D	0.25	9	1.6%	NS	--	--	NS	--	--
N-Nitrosodimethylamine (NDMA)	ng/L	811	314	497	0.236	25000	828	0.236 - 25000	GW-44D; MP-3 #01	0.11	**314**	**38.7%**	NS	--	--	NS	--	--

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Groundwater Exceedances Since May 2010 - More than 10 Detections
Summary Statistics and Criteria Comparisons
Olin Chemical, Wilmington, Massachusetts

Chemical	Units	Analyzed	Detects	Non Detects	Min Det	Max Det	Avg Det	Det Range	Max Location	RSL GwTapJun2017			MCL			SMCL		
										Value	# Exceed	% Exceed	Value	# Exceed	% Exceed	Value	# Exceed	% Exceed
N-Nitrosodiphenylamine	ug/L	625	97	528	0.26	360	61.2	0.26 - 360	GW-16R	12	38	6.1%	NS	--	--	NS	--	--
Pesticides/PCBs																		
Metals and Cyanide																		
Aluminum	ug/L	456	311	145	14	1900000	48000	14 - 1900000	MP-2 #01	2000	45	9.9%	NS	--	--	200	**121**	**26.5%**
Antimony	ug/L	381	20	361	1.5	15	3.56	1.5 - 15	GW-84D	0.78	20	5.2%	6	2	0.5%	NS	--	--
Arsenic	ug/L	381	191	190	0.12	260	13.3	0.12 - 260	MP-3 #01	0.052	**191**	**50.1%**	10	43	11.3%	NS	--	--
Barium	ug/L	381	362	19	3.5	1500	50.8	3.5 - 1500	BR-1	380	2	0.5%	2000	0	0.0%	NS	--	--
Beryllium	ug/L	381	47	334	0.19	210	21.5	0.19 - 210	MP-3 #01	2.5	14	3.7%	4	12	3.1%	NS	--	--
Cadmium	ug/L	381	67	314	0.14	200	10.3	0.14 - 200	MP-1 #01	0.92	28	7.3%	5	12	3.1%	NS	--	--
Chromium	ug/L	778	252	526	0.55	2000000	39900	0.55 - 2000000	MP-2 #01	2200	34	4.4%	100	51	6.6%	NS	--	--
Chromium-Hexavalent	ug/L	368	38	330	0.45	37000	977	0.45 - 37000	BR-1	0.035	**38**	**10.3%**	NS	--	--	NS	--	--
Cobalt	ug/L	381	186	195	0.72	12000	400	0.72 - 12000	MP-1 #01	0.6	186	48.8%	NS	--	--	NS	--	--
Copper	ug/L	381	74	307	1.7	9700	690	1.7 - 9700	MP-1 #01	80	15	3.9%	1300	8	2.1%	1000	8	2.1%
Iron	ug/L	486	425	61	14	3300000	78600	14 - 3300000	MP-1 #01	1400	**215**	**44.2%**	NS	--	--	300	**290**	**59.7%**
Lead	ug/L	381	51	330	1.3	34	4.05	1.3 - 34	GW-45D	15	3	0.8%	15	3	0.8%	NS	--	--
Manganese	ug/L	433	420	13	1.2	250000	7240	1.2 - 250000	GW-70D; MP-1 #01	43	**354**	**81.8%**	NS	--	--	50	**350**	**80.8%**
Mercury	ug/L	381	33	348	0.06	3.1	0.345	0.06 - 3.1	MP-1 #01	0.063	32	8.4%	2	2	0.5%	NS	--	--
Nickel	ug/L	433	218	215	1.2	9900	284	1.2 - 9900	MP-1 #01	39	35	8.1%	NS	--	--	NS	--	--
Silver	ug/L	381	17	364	2	32000	5230	2 - 32000	MP-1 #01	9.4	14	3.7%	NS	--	--	100	8	2.1%
Sodium	mg/L	778	778	0	0.85	27000	353	0.85 - 27000	MP-1 #01	NS	--	--	NS	--		250	**89**	**11.4%**
Thallium	ug/L	381	18	363	0.12	5.8	0.928	0.12 - 5.8	GW-45D	0.02	18	4.7%	2	2	0.5%	NS	--	--
Tin	ug/L	381	15	366	7	890000	60900	7 - 890000	MP-1 #01	1200	3	0.8%	NS	--	--	NS	--	--
Vanadium	ug/L	381	112	269	1.3	280	14.3	1.3 - 280	GW-52S	8.6	21	5.5%	NS	--	--	NS	--	--
Zinc	ug/L	381	156	225	1.6	25000	1170	1.6 - 25000	GW-202BRS	600	21	5.5%	NS	--	--	5000	11	2.9%
Dissolved Metals and Cyanide																		
Aluminum	ug/L	438	132	306	13	1900000	35700	13 - 1900000	MP-2 #01	2000	**45**	**10.3%**	NS	--	--	200	**77**	**17.6%**
Chromium	ug/L	438	403	35	1.1	2300000	10800	1.1 - 2300000	MP-2 #01	2200	9	2.1%	100	44	10.0%	NS	--	--
Iron	ug/L	95	84	11	17	2900000	95700	17 - 2900000	MP-1 #01	1400	**64**	**67.4%**	NS	--	--	300	**71**	**74.7%**
Manganese	ug/L	13	13	0	11	22000	3260	11 - 22000	GW-202BRS	43	**12**	**92.3%**	NS	--	--	50	**12**	**92.3%**
Sodium	mg/L	32	32	0	12	22000	1940	12 - 22000	MP-1 #01	NS	--	--	NS	--	--	250	**18**	**56.3%**
General Chemistry																		
Chloride	mg/L	1202	1194	8	0.38	17000	293	0.38 - 17000	MP-1 #01	NS	--	--	NS	--	--	250	**184**	**15.3%**
Nitrate	mg/L	714	448	266	0.017	38	1.91	0.017 - 38	GW-304	3.2	66	9.2%	10	15	2.1%	NS	--	--
Nitrite	mg/L	713	23	690	0.01	1	0.19	0.01 - 1	MP-4 #02	0.2	6	0.8%	1	0	0.0%	NS	--	--

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Chemical	Units	Analyzed	Detects	Non Detects	Min Det	Max Det	Avg Det	Det Range	Max Location	RSL GwTapJun2017			MCL			SMCL		
										Value	# Exceed	% Exceed	Value	# Exceed	% Exceed	Value	# Exceed	% Exceed
Sulfate	mg/L	1202	1185	17	1.2	100000	1110	1.2 - 100000	MP-1 #01	NS	--	--	NS	--	--	250	**393**	**32.7%**
Total Dissolved Solids	mg/L	25	25	0	34	1600	736	34 - 1600	SL-5	NS	--	--	NS	--	--	500	**14**	**56.0%**
Dissolved General Chemistry																		
Total Dissolved Solids	ug/L	23	23	0	60000	1900000	854000	60000 - 1900000	SL-5; SL-6	NS	--	--	NS	--	--	500000	14	**60.9%**
EPH																		
Other Analyses																		
Dimethylformamide	ug/L	183	16	167	5.8	380	91.3	5.8 - 380	GW-80BR	6.1	15	8.2%	NS	--	--	NS	--	--
Formaldehyde	ug/L	253	36	217	5.1	2400	264	5.1 - 2400	MP-3 #01	0.43	**36**	**14.2%**	NS	--	--	NS	--	--
Hydrazine	ug/L	255	32	223	0.054	230	11.3	0.054 - 230	GW-307	0.0011	**32**	**12.5%**	NS	--	--	NS	--	--
Kempore (Azodicarbonamide)	ug/L	178	11	167	250	5200	1100	250 - 5200	SL-6	NS	--	--	NS	--	--	NS	--	--
Opex	ug/L	178	11	167	29	280	106	29 - 280	GW-83D; GW-87D	NS	--	--	NS	--	--	NS	--	--
Perchlorate (organic)	ug/L	183	18	165	0.21	14	5.47	0.21 - 14	GW-44D; MP-3 #01	1.4	11	6.0%	15	0	0.0%	NS	--	--
VPH																		
Ethylbenzene	ug/L	71	14	57	0.35	5.2	2.57	0.35 - 5.2	GW-16R	1.5	**10**	**14.1%**	700	0	0.0%	NS	--	--
Methyl tert-butyl ether	ug/L	71	12	59	0.32	71	12.7	0.32 - 71	GW-16R	14	3	4.2%	NS	--	--	NS	--	--

Note: bold values exceed standard in more than 10% of samples analyzed for.

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